

## Title: 3D-Printed Piezoelectric Actuators

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### **Abstract**

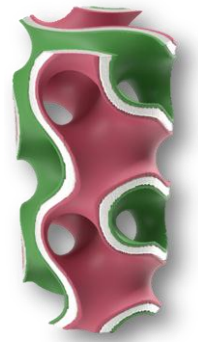
Usually smart piezoelectric actuators are driven far away from their resonances to avoid control and design efforts. Being in a sharp contrast to that we propose actuator designs, that consider the structural conformity of structurally integrated actuators. This strategy requires perfect impedance-matched actuators, whereas their transfer functions are matched to the structural system of interest. Consequently the actuator characteristics are not linear anymore. The main advantage of structurally conformed actuators is a perfect power transfer to the mechanical structures. But we have to innovate a paradigm shift: such low-energy concepts require a simultaneous design of all components from the very first beginning. Furthermore we found out, that such high-sophisticated actuators have extreme complex topologies, especially in three-dimensional cases.

Additive manufacturing seems to be the most-promising fabrication method for impedance-matched actuators even against the background, that we have to develop a print technique for piezoelectric materials.

In this presentation we will explain the concept of low-energy actuators that can be highly loaded, yielding in completely new actuator geometries. We will present 3D-printing techniques for piezoelectric materials and we will propose several new actuator types. Experimental results prove the performance of 3D-printed piezoelectric actuators.

### **Biography**

Mr. Marc Sparenberg is a Master of Systems Engineering and a Bachelor of Mechanical Engineering. As a scholarship holder of the *Campus Functional Materials and Functional Structures*, that is an institution of the Technical University of Clausthal in association of BAM, Berlin, and DLR, Braunschweig, he researches on the topic "*Self-organized Multifunctional Structures for Adaptive Lightweight Constructions*" for his Ph.D.. Within his aspires to achieve his Ph.D. he won the Best Paper Finalist Award at the "*ASME Smart Materials, Adaptive Structures, and Intelligent Structures Conference*". Mr. Sparenberg filed several patent applications in the field of smart structures. Within DLR's *Competition of Visions 2021/2022* he and his team presented the best idea and in *2018/2019* he proposed one of the best ten German idea projects to DLR's executive board. Furthermore in 2019 he won the third place of DLR-FA's *Competition of Ideas 2019*.



*Novel design of a piezoelectric actuator*